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SEPARATING DEVICE, TAPE GUIDE INCLUDING SUCH A  
DEVICE, AND METHOD USING SUCH A DEVICE

Technical field of the invention

The present invention concerns a cover separating device for, and a method of, exposing components, carried by a carrier tape, at a picking position in a component mounting machine. The invention also concerns a tape guide including such a separating device. The carrier tape is arranged to be fed towards the separating device. The components are positioned in sequence and covered by the cover, which is attached to the carrier tape.

Background of the invention

Generally, within the field of manufacture and assembly of circuit boards, electronic components are fed to a component mounting machine for mechanically and/or electrically mounting the components onto a circuit board. These surface mounted components are often delivered spaced apart along the length of a component tape, which consists of a lower carrier tape provided with compartments, one for each component, and an upper cover, or cover tape or protective tape. After the positioning of the electronic components in the corresponding compartments, the cover tape is attached to the carrier tape, for instance by providing either the cover tape or the carrier tape with adhesive areas, or by fusing the cover tape to the carrier tape, and the component tape is wound on a component reel. Then, the component reel is transferred to a component mounting machine which feeds a component to a certain predetermined picking position where it can be picked, or collected, by a pick-up head. Prior to the picking of the components, each component has to be exposed so as to make it avail-

able for picking. WO 86/00778 shows a cassette magazine for a component mounting machine using the above described method.

According to prior art, the exposure of the component is achieved by removing the cover tape from the carrier tape. However, there is a considerable risk of the cover tape getting entangled after removal from the carrier tape. Furthermore, the cover tape can also be electrostatically attractive. Therefore, the cover tape is fed away by a separate mechanism in order for the cover tape not to disturb the picking of components. The cover tape is either pulled straight up from the carrier tape or pulled obliquely over an edge. There are today generally two methods of handling the cover tape after removal from the carrier tape. The most common method is to wind the cover tape onto a winding hub. This method is reliable, but very complicated and time consuming. Furthermore, the hub has to be cleared of the cover tape when the component tape is replaced.

When using a winding hub for handling the cover tape, the loading of a component tape in a component mounting machine involves the following steps. Placing the component tape reel into the tape holder of a magazine; introducing the free end of the component tape into a feeding mechanism such that feeding pins engage corresponding holes provided in the component tape; separating, by hand, the end of the cover tape from the end of the carrier tape for a distance sufficient to attach the cover tape to a winding hub; bringing the cover tape end past a stripping edge which is combined with a plate or a locking mechanism that secures the carrier tape; lowering the locking mechanism over the carrier tape for holding the carrier tape against the feeding mechanism; bringing the end of the cover tape and attaching it to the winding hub; and stretching the cover tape by rotating the winding hub.

As an alternative to the winding hub for removing and collecting the cover tape it is known in the art to use nip rollers for removing the cover tape and feeding it into a receptacle, either direct or via a tape cutting device. However, the use of nip rollers involves a considerable risk of the cover tape, especially when being provided with adhesive areas, sticking to the rollers instead of ending up in the waste disposal.

The two methods described have in common that the cover tape end by hand has to be brought to the device that handles the cover tape. Generally, this requires that a considerable length of the end of the cover tape has to be separated from the end of the carrier tape. Thus, the first decimetres of a new carrier tape are not provided with components. Otherwise, numerous components would be wasted during loading. However, when reloading a tape reel that already has been partly used, the tape is provided with components throughout, and consequently a large number of components will be wasted.

#### 20 Summary of the invention

It is therefore an object of the present invention to provide an improved and simplified method, and a corresponding device, for exposing components provided carried by a carrier tape.

25 Another object of the present invention is to provide a method, and a corresponding device, that reduces the required time for loading a carrier tape into a component mounting machine.

A further object of the present invention is to provide a method, and a corresponding device, that reduces the number of components wasted when reloading a carrier tape into and/or unloading a carrier tape from a component mounting machine.

35 These and other objects are achieved according to the present invention by providing a device, a tape guide, and a method having the features defined in the

independent claims. Preferred embodiments are defined in the dependent claims.

For the purpose of clarity, the term lateral refers to the lateral direction of the carrier tape. The terms  
5 distal and proximal refers to the direction opposite to and along the feeding direction of the carrier tape, respectively.

The present invention is based on the advantageous insight of only partially separating a cover tape from a  
10 carrier tape for exposure of a component, leaving a portion of the cover tape at least partially attached to the carrier tape after the exposure and picking of the component. Preferably, this is achieved by feeding the carrier tape, carrying the components which are covered  
15 by a cover tape, towards a separating device, separating and lifting a portion of the cover from the carrier tape, leaving the remaining portion of the cover at least partially attached to the carrier tape, turning or bringing the lifted portion of the cover aside, thereby  
20 exposing the components.

The solution according to the invention provides several advantages over the existing solutions. For example, the need for a separate device handling the cover tape after separation from the carrier tape is completely eliminated. This is due to the fact that the  
25 cover tape is never completely removed from the carrier tape. Thus, the mechanism handling the cover tape, for exposing the component for enabling the component to be picked by a pick-up head, does not have to be combined with a device for pulling and/or keeping the cover tape  
30 away from the picking position and thereby avoiding interference of the picking action by an entangled cover tape. Hence, the portion of the cover tape and the carrier tape that has been fed past the picking position, and where the carrier tape has been emptied of components,  
35 will remain at least partly attached to each

other and can thereby be handled as one integral unit in the same manner as the sole carrier tape is handled according to prior art.

Furthermore, the loading of the carrier tape into  
5 the component mounting machine is facilitated in that a length at the end of the cover tape does not have to be removed from the carrier tape and subsequently attached to a winding hub, nip rollers, or the like. This substantially reduces the actual loading time for each  
10 separate carrier tape and thereby improves the time efficiency of the entire manufacturing process. The step of clearing the winding hub from the cover tape when unloading a carrier tape after use, e.g. after the components provided on that carrier tape have run out, is  
15 also eliminated by the method according to the invention.

The loading of a carrier tape in accordance with advantageous embodiments of the present invention involves bringing the carrier tape, provided with components covered by a cover tape, into a guiding means provided with a separating device. A short length of the cover tape is separated from the carrier tape and the end of the carrier tape is brought past the distal end of the separating device, i.e. the end of the separating  
25 device facing the carrier tape, enough to position said distal end in between the ends of the carrier tape and the cover tape, and enough to allow a feeding mechanism to engage the carrier tape. Bringing the carrier tape and cover tape past the distal end of the separating device can be achieved by pulling the separated end of the  
30 cover tape in a direction towards the separating device, or by pushing the carrier tape in that direction. The separation of a short length of the cover tape can be performed by hand or be provided beforehand when attaching  
35 ing the cover tape to the carrier tape. Following the picking, the portion of the carrier tape that has been

fed past the picking position, and where the carrier tape has been emptied of components, is cut by a cutting means and disposed of.

Unloading the carrier tape is performed by simply  
5 pulling the carrier tape back, i.e. in the direction opposite to the feeding direction. Hence, the components provided in the compartments positioned between the distal end of the separating device and the picking position, just prior to unloading of the carrier tape, will  
10 be at least partially exposed and can thereby be wasted. However, the number of wasted components is limited by the length of the separating device, provided that the picking position is positioned just following the proximal end of the separating device, i.e. the end of the  
15 separating device opposite to the distal end. For instance, if the separating device has a length of two centimetres, the number of wasted components is the number of components contained on two centimetres of the carrier tape. Furthermore, when reloading a carrier tape  
20 that has already been partly used and unloaded, there will be no further waste of components. This is due to the fact that the necessary separation of the end of the cover tape from the carrier tape already has been achieved.

25 Thus, the number of wasted components resulting from loading, unloading and reloading a carrier tape is considerably decreased when using the method of exposing the components according to the invention.

According to preferred embodiments of the invention,  
30 the separating device comprises two main sections, a first, distally positioned section for separating and lifting a portion of the cover tape from the carrier tape, and a second section for turning the separated portion of the cover tape aside, thereby exposing the  
35 component. These sections can either be separate, or

separable, parts, or be integrated sections of one inseparable device.

Advantageously, the first section is provided with a tip positioned at the distal end of the separating device and protruding in the distal direction, i.e. opposite to the feeding direction of the carrier tape, from a body portion. Preferably, said body portion is mounted on a guiding device, which is provided for guiding the carrier tape within the component mounting machine.

10 In order to minimise the risk of ripping the cover tape, it is important that the cover tape is not cut by the tip portion of the first section of the separating device. In accordance with a preferred embodiment, this is achieved by giving the tip a vertically and laterally  
15 rounded shape, and an increased vertical and lateral thickness in the proximal direction. The lateral and vertical extension of the tip portion can be made greater or smaller in dependence of the features of the cover and carrier tapes for which it is intended, e.g. a  
20 tip portion with a greater lateral extension is suitable for a wider cover tape.

According to an alternative embodiment of the invention, the distal end of the tip portion is arranged to be movable in the lateral or the vertical direction,  
25 or both. Thereby, the position of the distal end automatically conforms to the shape, position and configuration of the component tape and the components. This is particularly useful when handling a component tape provided with large components having portions thereof contacting the cover tape or protruding above the compartments. There are several ways of providing the distal  
30 end of the tip portion with the desired movability, for instance by producing the tip portion from a flexible material, or by providing a ball joint between the tip portion and the body portion, or between the first and  
35 the second section.



In accordance with an alternative embodiment, the tip is planer blade shaped.

Further, the cover tape is generally attached to the carrier tape by the provision of adhesive, or fused, areas along the sides of the cover tape. Therefore, the distal end of the tip is preferably arranged to be positioned between these areas, at a distance from the side of the cover tape, preferably close to or at the lateral centre of the cover tape. In an alternative embodiment, the distal end is arranged to be positioned laterally displaced from the lateral centre of the cover tape.

The preferred method of separating and lifting a portion of the cover tape from the carrier tape, when using a cover tape as described above, is to completely separate the cover tape from the carrier tape at one side, while keeping the cover tape attached to the carrier tape at the other side. This is achieved according to preferred embodiments of the invention by providing the body portion of the distal section with a lateral extension in one direction only, preferably beyond the area where the cover tape is attached to the carrier tape. Thereby, the cover tape is inevitably separated from the carrier tape at the side where the body portion is positioned. The lateral extension of the body portion beyond the side of the cover tape also enables the body portion to be fastened or mounted to the guiding means or the component mounting machine.

After the separation of a portion of the cover tape from the carrier tape, there is a risk of the components escaping from their compartments. In order to prevent this, the body portion, according to specific embodiments of the invention, has an elongated extension in the feeding direction, and forms a cover that covers each component from the moment said component passes the tip portion until it reaches the picking position.

After the separation and lifting of a portion of the cover tape from the carrier tape, this portion has to be brought aside, or deflected, in order to ensure that the components are completely exposed at the picking position, and that the cover tape does not interfere with the picking of the components. According to the invention, this is achieved by providing the separating device with a second section for turning the separated portion of the cover tape aside. As described above, this section can form a section integrated with the first section, or can form a separate part which can be removably mounted to the first section. As an alternative, both the first section and the second section can be separately mounted to another part of the component mounting machine, e.g. a tape guiding device.

Components to be mounted in component mounting machines assume a wide variety of sizes and shapes. Therefore, the compartments for these components, and, hence, the carrier tapes and the cover tapes, are adapted to the size and shape of the carried component. Thus, the width of the cover tape that has to be brought aside vary. According to an embodiment of the present invention, the second section is provided with means for guiding the separated portion of the cover tape to an upright position, essentially perpendicular to the carrier tape, at the picking position. Thereby, the cover tape would not interfere with the picking process. However, when using a carrier tape provided with a wide cover tape, the raising of the cover tape to an upright position would require a considerably large free space above and slightly beyond the separating device. This problem is solved by providing said second section with means for guiding the separated portion of the cover tape completely to the side of or underneath the carrier tape, e.g. by folding the cover tape. In an alternative embodiment, the means for guiding the separated portion

of the cover tape is arranged to fold the cover tape about said means. According to a further alternative embodiment of the invention said second section is provided with means for rolling up the cover tape to one  
5 side.

There are several alternatives for providing the second section as a separate part of the separating device. According to one embodiment of the invention, the second section is mounted on the rear of the body portion and can be laterally displaceable, as described  
10 above. According to an alternative embodiment, the second section is provided behind the first section, either engaging or spaced from the first section. This results in the second section being replaceable, for adaptation  
15 to the characteristics of the cover and/or carrier tape, without having to replace the first section, and vice versa.

According to specific embodiments of the invention, the separating device is adjustable in order to adapt  
20 the separating device to the width of the cover tape. In one embodiment the adjustability is achieved by providing the second section, for turning the cover tape aside, with the ability to be displaced laterally, or by providing said section with the ability to be pivoted in  
25 the horizontal plane, while the first section remains fixed. In an alternative embodiment, the entire separating device is arranged to be pivoted about the tip portion.

Furthermore, and as an alternative embodiment, the separating and lifting effect of the tip portion is enhanced by providing the tip portion with an outlet of pressurised air. In a further alternative embodiment, the tip portion is an outlet of pressurised air, said  
30 outlet being the sole means for providing said separating and lifting effect. These alternatives are particularly useful when the components carried by the carrier  
35

tape are at least partially in contact with the cover tape.

According to an alternative embodiment of the present invention, the exposure of the components is  
5 achieved by providing the separating device with a sharp distal end for cutting or ripping the cover tape into two parts, or halves. Following the cutting of the cover tape, the cut portions are brought to their respective side by the second section of the separating device,  
10 provided with means for turning portions of the cover tape aside, thereby exposing the components at the picking position. According to this embodiment, said means for turning the cover tape aside comprises duplicate means provided on each side of the separating the device,  
15 thereby leaving the component exposed between the portions of the cover tape that has been turned aside.

According to an aspect of the present invention, the separating device is supported by a tape guide, as will be described below.

20 Further details and aspects of the invention will become apparent from the following detailed description of embodiments of the invention, reference being made to the accompanying drawings wherein like reference numerals refer to similar parts throughout.

## 25 Brief description of the drawings

Figure 1 is a schematic side view illustrating the principle of exposing and picking a component in a component mounting machine according to the state of the art.

30 Figure 2 is a schematic side view illustrating the corresponding principle of exposing and picking a component in a component mounting machine according to the invention.

Figure 3 is a top view illustrating the exposure of  
35 a component according to an embodiment of the invention.

Figure 4 is a perspective view illustrating the separation and turning aside of a portion of the cover tape according to an embodiment of the invention.

Figures 5, 6, and 7, are perspective views of the separating device according to alternative embodiments of the invention.

Figure 8 is a perspective view illustrating the separation and turning aside of a portion of the cover tape according to an alternative embodiment of the invention.

Figure 9 schematically shows the turning aside of a portion of the cover tape according to alternative embodiments of the present invention.

Figure 10 is a top view illustrating a separating device according to yet another alternative embodiment of the invention.

Figure 11 is a schematic illustration of the loading of a carrier tape according to the invention.

Figure 12 is a side view illustrating a tape guide according to a specific embodiment of the invention.

Figure 13 is a perspective view illustrating the tape guide according to an alternative embodiment.

#### Detailed description of preferred embodiments

With reference to figure 1, there is shown in schematic form how the exposure of components for enabling picking is achieved according to the state of the art. A component tape 1, comprising a carrier tape 2, provided with compartments 3 filled with components 6, and a cover tape 4, is introduced into a feeding mechanism 8. The pins of the feeding mechanism 8 engage corresponding holes 5 provided in the carrier tape 2. The end of the cover tape 4 is removed from the carrier tape 2 and wound onto a winding hub 50, which is provided with a separate feeding mechanism (not shown). The cover tape 4 is brought past a first plate 54 provided with a stripping edge, and the cover tape 4 is stretched by a sepa-

rate reel 52, applying pressure on the cover tape 4. A second plate 56 is provided after the first plate 54 for preventing small components 6, that can be electrostatically adhered to the cover tape 4, from sticking to and following the removed portion of the cover tape 4 when said portion is fed away. The second plate 56 extends to a position where the components 6 are picked by a pick-up head 7.

Referring to figure 2, a preferred embodiment of the present invention is schematically illustrated. The component tape 1, as described above, is introduced into a feeding mechanism 8 for engagement with the carrier tape 2, as described above. The carrier tape 2 is fed past a separating device 10, which acts to separate a portion of the cover tape 4 from the carrier tape 2, and to thereby expose the components 6 at a picking position for enabling picking by a pick-up head 7. A portion of the cover tape 4 remains at least partially attached to the carrier tape 2 after said portion have been fed past the separating device 10.

Referring now to figures 3 and 4, the separating device 10 according to a preferred embodiment of the invention is shown in greater detail. The separating device 10 comprises a first section 11 and a second section 14, the first section 11 comprising a tip portion 12, positioned at the distal end of the separating device 10, and a body portion 13. The tip portion 12 extends distally from the body portion 13, has a laterally and vertically rounded shape, and has an increased thickness in the direction extending backwards from the distal end of the tip portion 12. The tip portion 12 can be made from a rigid material and be rigidly or flexibly mounted. As an alternative, the tip portion 12 is produced from a flexible material, and is either rigidly or flexibly mounted.

The body portion 13 has a lateral extension in one direction only, the extension being sufficient to extend the body portion 13 beyond the lateral extension, or the side, of the cover tape 4. Further, the body portion 13 is elongated and has an extension in the proximal direction. Thus, the body portion 13 forms a cover plate preventing the exposure of each component 6 until said component 6 reaches the picking position. This will ensure that the components 6 can not escape from their respective compartments 3. Furthermore, the first section 11 prevents small components, that might be electrostatically adhered to the cover tape 4, from sticking to and following the lifted portion of the cover tape 4.

The second section 14 is provided on the body portion 13 of the first section 11, and extends vertically from, and essentially perpendicular to, the first section 11. Said sections 11, 14 constitute portions of a single, integral device 10.

The separating device 10, according to this embodiment, is particularly well suited for cover tapes that are provided with adhesive, or fused, areas 4a, 4b along the sides of the cover tape 4, as can be seen in figure 3. The separating device 10 is supported by a tape guide 20 that ensures that the carrier tape 2 is properly positioned relative the separating device 10 and the pick-up head 7. The separating device 10 is positioned such that the distal end of the tip portion 12 is positioned at the lateral centre of the cover tape 4, between the adhesive areas of the cover tape 4. According to this embodiment, the position and orientation of the separating device 10 is fixed relative the tape guide 20.

When feeding the carrier tape 2 in the feeding direction, the tip portion 12 separates and lifts the cover tape 4, at the lateral centre of the cover tape 4, from the carrier tape 2. The lateral extension of the body portion 13 to one side ensures that the correspond-

ing side 4b of the cover tape 4 is separated from the carrier tape 2. The adhesive area 4a provided on the other side of the cover tape 4 is not affected by the separating device 10 and keeps that side of the cover tape 4 attached to the carrier tape 2. Following the separation of a portion of the cover tape 4 from the carrier tape 2, this portion is turned into an upright position by the second section 14. Thereby, the components 6 are completely exposed at the picking position.

Turning now to the figures 5-7, there is shown the separating device according to alternative embodiments of the present invention. The features of these alternative embodiments correspond to the features described above with reference to the embodiment shown in figures 3 and 4, unless otherwise stated. These alternative embodiments all include the possibility of adjusting the separating device for adaptation to the widths of the cover and carrier tapes 4, 2, which can vary greatly.

The separating device 110, according to the embodiment shown in figure 5, differs from the above described separating device 10, in that the entire separating device 110 can be pivoted in the horizontal plane about the tip portion 112 of the first section 111, as is indicated by the arrow in the figure.

Figure 6 shows a separating device 210 in which the second section 214 constitute a separate part of the separating device 210. The second section 214 is supported by first section 211 and positioned on top of said first section 211. The second section 214 is laterally displaceable, and can also be replaced for adaptation to the carrier and cover tapes 2, 4.

The separating device 310, according to the embodiment shown in figure 7, comprises separate first and second sections 311, 314. The second section 314 is provided behind the first section 311, either engaging or spaced from the first section 311. The second section



314 can be pivoted in the horizontal plane about the distal end of the second section 314, as is indicated by the arrow in the figure. The second section 314 is elongated and forms a cover plate preventing the exposure of the components. The first and second sections 311, 314 can be jointly or separately mounted to another part of the component mounting machine, e.g. a tape guide.

The second section 14, 114, 214, 314, or the rear of the body portion 13, 113, 213, 313 when the second section is arranged on the body portion, can be provided with a sharp edge for partly separating a portion of the adhesive area 4a of the cover tape 4 from the carrier tape for the exposure of particularly large components. Said edge is provided on the side of the separating device 10, 110, 210, 310 opposite to the lateral extension of the body portion. This is particularly useful when handling wide carrier and cover tapes.

Turning now to figure 8, there is shown an alternative embodiment of the invention applicable to a wider tape, e.g. having a width of 12 or 16 mm. According to this embodiment, the tip portion 412 of the separating device 410 has a greater lateral extension than the tip portion 12 of the embodiment shown in figure 4. The increased lateral extension of the tip portion 412 results in the cover tape 4, following the separation from the carrier tape 2, folding about the second section 414 of the separating device 410. An alternative to folding the wider cover tape 4 about the second section is to increase the vertical extension of the second section. However, this would require a substantial amount of free space above the separating device.

Figure 9 further shows schematically how a portion of the cover tape is turned aside according to alternative embodiments of the present invention. The alternatives include bringing the separated portion of the

cover tape 4 into an upright position, which requires free space above the separating device; folding the separated portion completely to the side and leaving the portion in a horizontal position, which requires free space adjacent the separating device; rolling up the separated portion to the side, which requires the second section having a tube shaped portion(not shown); or folding down the separated portion of the cover tape 4 underneath the carrier tape 2.

Referring now to figure 10, there is shown an alternative embodiment of the present invention, suitable for a cover tape 4 provided with adhesive areas along the sides of the cover tape 4a, 4b only. The separating device 510 comprises a tip portion 512, having a sharp distal end, a body portion 513 and two separate sections 514a, 514b for turning the cover tape aside. The body portion 513 has the same features as the body portion 13, as described above with reference to figure 3 and 4. The sharp distal end of the tip portion 512 is positioned at the lateral centre of the cover tape 4 and is arranged to cut the cover tape into two halves. Following the cutting of the cover tape 4, the portions of the cover tape 4 not provided with adhesive areas are brought to their respective side by the sections 514a, 514b which extends vertically from, and essentially perpendicular to, the body portion 513, thereby exposing the components at the picking position. As an alternative, the attached cover tape 4 could have an inherent flexibility and tension, e.g. provided at the assembly of the component tape 1, such that the cut portions of the cover tape 4 are brought aside by themselves, e.g. rolled up to the side. According to this alternative, no sections for turning the cover tape 4 aside is required.

Figure 11 shows in schematic form the loading of a component tape 1 into a component mounting machine according to an embodiment of the invention. A short por-

tion of the end of the cover tape 4 has been separated from the carrier tape 2. The end of the carrier tape 2 is brought past the distal end of the tip portion 12 of the separating device 10, enough to position said distal end in between the respective ends of the carrier tape 2 and the cover tape 4, and enough to allow a feeding mechanism to engage the carrier tape 2. The separated end of the cover tape 4 is then grasped and pulled in the feeding direction, thereby bringing the carrier tape 2 and the cover tape 4 past the distal end of the separating device.

With reference to the figures 3, 12, and 13, there is shown a tape guide 20 for use in conjunction with a separating device 10 according to specific embodiments of the invention. The tape guide 20 comprises an elongated open-ended profile 21 with opposing elongated walls 22, 23 provided with grooves 27, for facilitating insertion of a component tape 1 and for guiding the component tape 1, and a base 24 connecting the elongated walls 22, 23. The base 24 is provided with an opening 28 for enabling the pins of a feeding device 8 to engage the holes 5 of the carrier tape 2. The tape guide 20 is provided with a separating device 10, as described above, either removably or fixedly mounted. As can be seen in figure 13, the separating device 10 is here shown with a planer blade shaped tip portion 612 according to an alternative embodiment of the invention. As obvious to a person skilled in the art, the tape guide 20 could be provided with any separating device according to the present invention.

The tape guide 20 is removably mounted to a component mounting machine and can be removed together with the component tape 1 when unloading the component tape 1 from the component mounting machine. To prevent the component tape 1 from being accidentally separated from the tape guide 20, when the tape guide 20 and the component

tape 1 is not mounted to a component mounting machine, the tape guide 20 is provided with a locking device 25 for fixing the component tape 1 relative the tape guide 20. The locking device 25 consists of a spring-loaded pivoted lever, at one end provided with a locking pin 26. When in use, the locking pin 26 engages a hole 5 of the carrier tape 2, thereby also keeping the carrier tape 2 at a position suitable for engagement by the feeding device 8. The locking pin 26 can also be seen in figure 3. The lever 25 is manually released when loading and unloading the component tape 1 from the tape guide 20, when the tape guide 20 is removed from the component mounting machine, and is automatically released when loading the tape guide 20, with or without a component tape 1, into the component mounting machine. The tape guide is preferably mounted to the component mounting machine using a snap-in locking arrangement.

As described above, several different shapes of the separating device are suggested herein. However, other shapes are contemplated and can be considered without extending beyond the scope of the invention, as defined in the accompanying claims. Furthermore, the use of a separating device according to the present invention does not necessarily require the use of a tape guide as described herein.

## CLAIMS

1. A cover separating device (10, 110, 210, 310, 410) for exposing components (6), carried by a carrier tape (2), at a picking position in a component mounting machine, the carrier tape (2) being arranged to be fed towards the device (10, 110, 210, 310, 410), the components (6) being positioned in sequence and covered by a cover (4), the cover (4) being attached to the carrier tape (2), characterised in that the device (10, 110, 210, 310, 410) is provided with means for exposing each component (6) at the picking position, while leaving a portion of the cover (4) at least partially attached to the carrier tape (2).

2. The device according to claim 1, wherein said means is also provided for cutting said cover (4) and splitting it into two parts.

3. The device according to claim 1, wherein said means is also provided for separating and lifting a portion of the cover (4) from the carrier tape (2), leaving the remaining portion of the cover (4) at least partially attached to the carrier tape (2), and for turning the lifted portion of the cover (4) aside.

4. The device according to claim 3, wherein said means for separating and lifting a portion of the cover (4) is arranged to separate and lift a lateral portion of the cover (4).

5. The device according to claim 4, wherein said means comprises a first section (11, 111, 211, 311, 411) for separating and lifting said lateral portion of the cover (4) from the carrier tape (2), and a second sec-

tion (14, 114, 214, 314, 414) for turning said lateral portion aside and thereby exposing said component (6).

5       6. The device according to claim 5, wherein said first section (11, 111, 211, 311, 411) is a front section comprising a tip portion (12, 112, 212, 312, 412) and a body portion (13, 113, 213, 313, 413), said body portion extending backwards from said tip portion.

10       7. The device according to claim 6, wherein the tip portion (12, 112, 212, 312, 412) is arranged to be movable in the lateral and/or the vertical direction.

15       8. The device according to claim 6, wherein the distal end of said tip portion (12, 112, 212, 312, 412) is arranged to be positioned at the lateral centre of the cover (4).

20       9. The device according to claim 6, wherein the distal end of said tip portion (12, 112, 212, 312, 412) is laterally displaced from the lateral centre of the cover (4).

25       10. The device according to any one of claims 6-9, wherein the tip portion (12, 112, 212, 312, 412) is vertically and laterally rounded, and has an increased vertical and lateral thickness in the proximal direction.

30       11. The device according to claim 10, wherein the tip portion (12, 112, 212, 312, 412) is laterally displaced from the lateral centre of the body portion (13, 113, 213, 313, 413).

35       12. The device according to claim 6, wherein said tip portion (612) is planer blade shaped.

13. The device according to any one of claims 6-12, wherein the tip portion is provided with an outlet of pressurised air for enhancing the separation and lifting of said lateral portion of the cover (4) from the carrier tape (2).

14. The device according to claim 6, wherein the tip portion is an outlet of pressurised air, said outlet being the sole means for separating and lifting said lateral portion of the cover (4) from the carrier tape (2).

15. The device according to claim 2, wherein said means comprises a first section (511) and at least one second section (514a, 514b), said first section (511) being a front section comprising a tip portion (512) and a body portion (513), said tip portion (512) having a sharp distal end for cutting said cover (4).

16. The device according to claim 15, wherein the sharp distal end is positioned at the lateral centre of the cover (4).

17. The device according to any one of claims 5-16, wherein said second section comprises means for bringing, at least at the picking position, the lifted portion of the cover (4) to an upright position, thereby exposing the component (6).

18. The device according to any one of claims 5-16, wherein said second section comprises means for folding the lifted portion of the cover (4) completely to the side, thereby exposing the component (6).

19. The device according to any one of claims 5-16, wherein said second section comprises means for rolling

up the lifted portion of the cover (4) to the side,  
thereby exposing the component (6).

20. The device according to any one of claims 5-19,  
5 wherein the device (110) is pivotable in a horizontal  
plane.

21. The device according to any one of claims 5-19,  
wherein said first and second sections (211, 214, 311,  
10 314) are separable.

22. The device according to claim 21, wherein the  
second section (214) is laterally displaceable.

15 23. The device according to claim 21, wherein the  
second section (314) is pivotable in a horizontal plane.

24. The device according to any one of claims 6-23,  
wherein said body portion (13, 113, 213, 313, 413, 513)  
20 is elongated, and wherein said body portion forms a  
cover plate preventing the exposure of each component  
(6) until said component (6) reaches the picking posi-  
tion.

25 25. The device according to any one of claims 5-23,  
wherein said second section (314) forms a cover plate  
preventing the exposure of each component (6) until said  
component (6) reaches the picking position.

30 26. A tape guide (20) for use in a component mount-  
ing machine for guiding a carrier tape (2), the tape  
guide comprising a device according to any one of claims  
1-25.

35 27. The tape guide (20) according to claim 26,  
wherein the tape guide (20) comprises an elongated open-



ended profile (21) with opposing elongated walls (22, 23) provided with means (27) for facilitating insertion of a carrier tape (2) and for guiding said carrier tape (2), and a base (24) connecting said elongated walls  
5 (22, 23).

28. The tape guide (20) according to claim 27, wherein said base (24) is provided with an opening (28) for enabling a feeding device (8) to engage the carrier  
10 tape (2).

29. The tape guide (20) according to any one of claims 26-28, further comprising a locking device (25) for fixing the carrier tape (2) relative the tape guide.  
15

30. A method of exposing components (6), carried by a carrier tape (2), at a picking position in a component mounting machine, the components (6) being positioned in sequence and covered by a cover (4), the cover (4) being  
20 attached to the carrier tape (2), comprising the steps of

separating and lifting a portion of the cover (4) from the carrier tape (2), leaving the remaining portion of the cover (4) at least partially attached to the carrier tape (2);  
25

turning the lifted portion of the cover (4) aside, thereby exposing the components (6).

31. The method according to claim 30, wherein the  
30 step of separating and lifting comprises the step of lifting a lateral portion of the cover (4).

32. The method according to claim 30 or 31, wherein the step of turning aside comprises the step of bringing  
35 the lifted portion of the cover (4) to an upright position, at least at the picking position.

33. The method according to claim 30 or 31, wherein  
the step of turning aside comprises the step of folding  
the lifted portion of the cover (4) completely to the  
5 side.

34. The method according to claim 30 or 31, wherein  
the step of turning aside comprises the step of rolling  
up the lifted portion of the cover (4) to the side.  
10

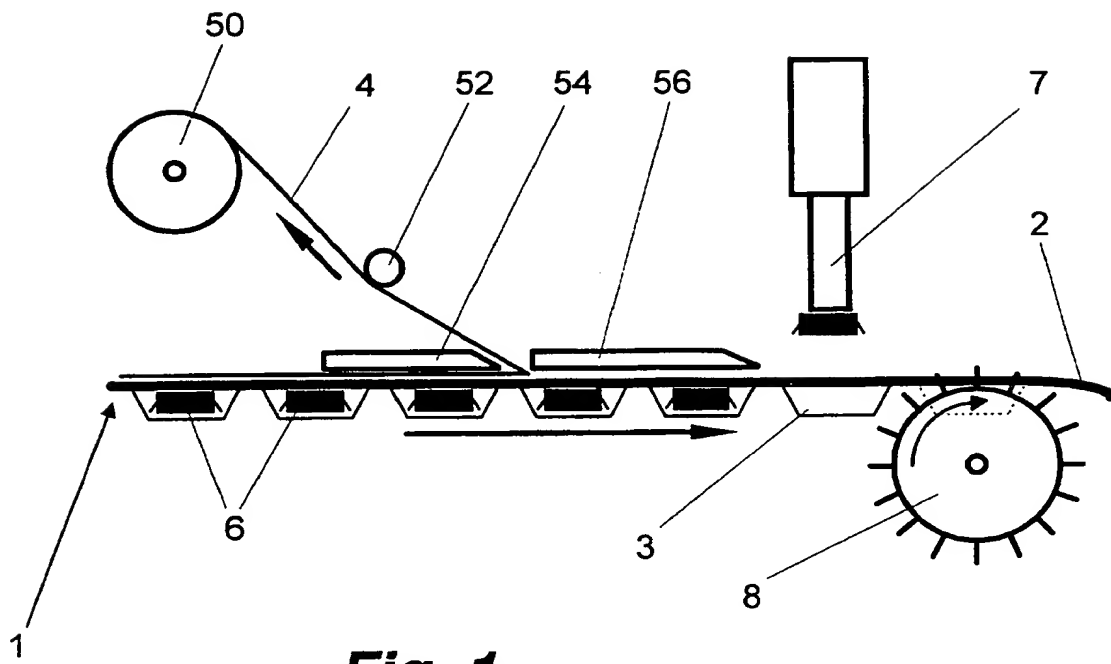
35. The method according to any one of claims 30-  
34, further comprising the step of covering each compo-  
nent (6), by a separating device (10, 110, 210, 310,  
410), from the step of separating said portion of the  
15 cover (4) until said component (6) reaches the picking  
position.

## ABSTRACT

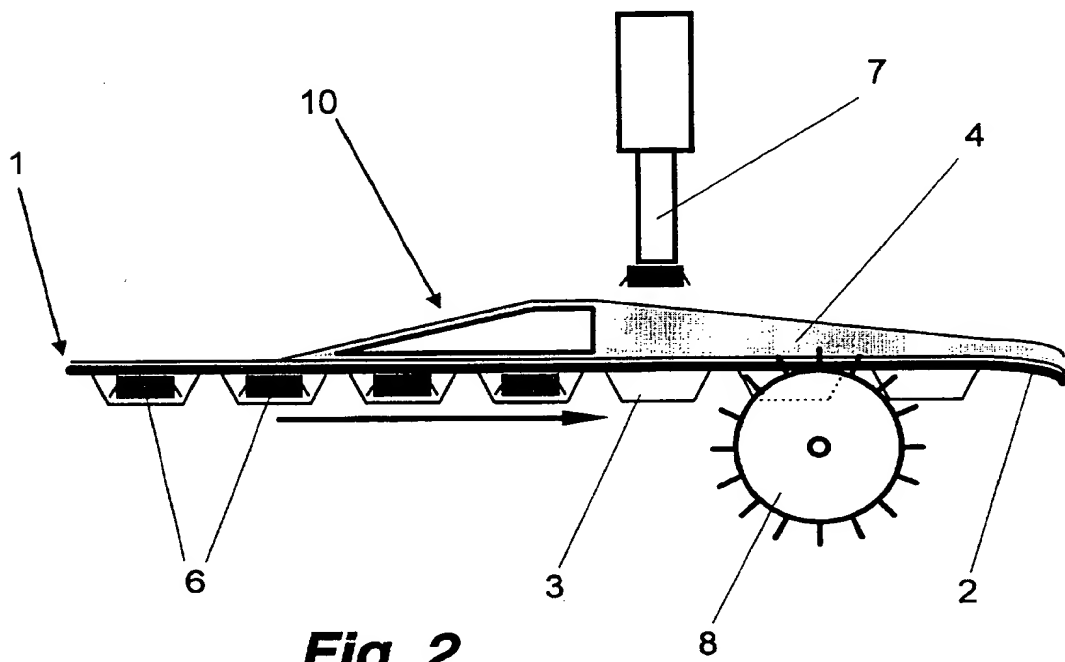
A cover separating device 10 for, and a method of,  
5 exposing components 6, carried by a carrier tape 2, at a  
picking position in a component mounting machine, and a  
tape guide 20 including such a device 10. The components  
6 are positioned in sequence and covered by a cover 4,  
which is attached to the carrier tape 2. The carrier  
10 tape 2 is introduced into a feeding mechanism 8 for en-  
gagement with holes 5 in the carrier tape 2. The carrier  
tape 2 is fed past the separating device 10, which acts  
to separate a lateral portion of the cover tape 4 from  
the carrier tape 2 and to bring the separated portion  
15 aside, thereby exposing the components 6 at a picking  
position for enabling picking by a pick-up head 7. The  
portion of the cover tape 4 that has been fed past the  
separating device 10 remains at least partially attached  
to the carrier tape 2.

20

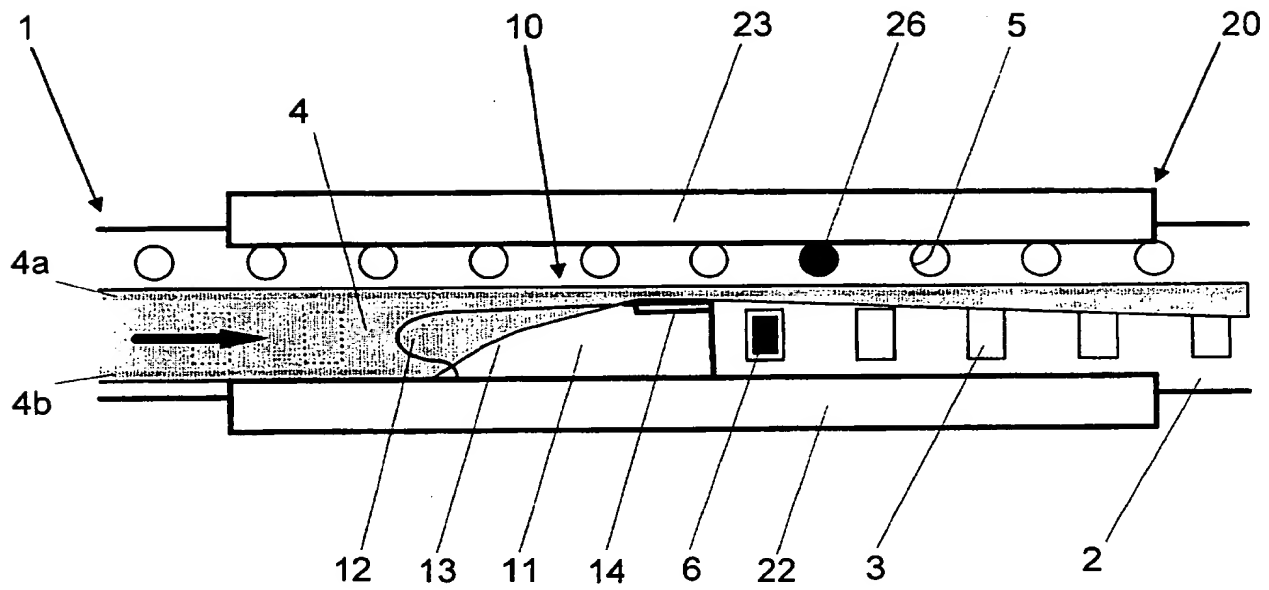
Fig. 2



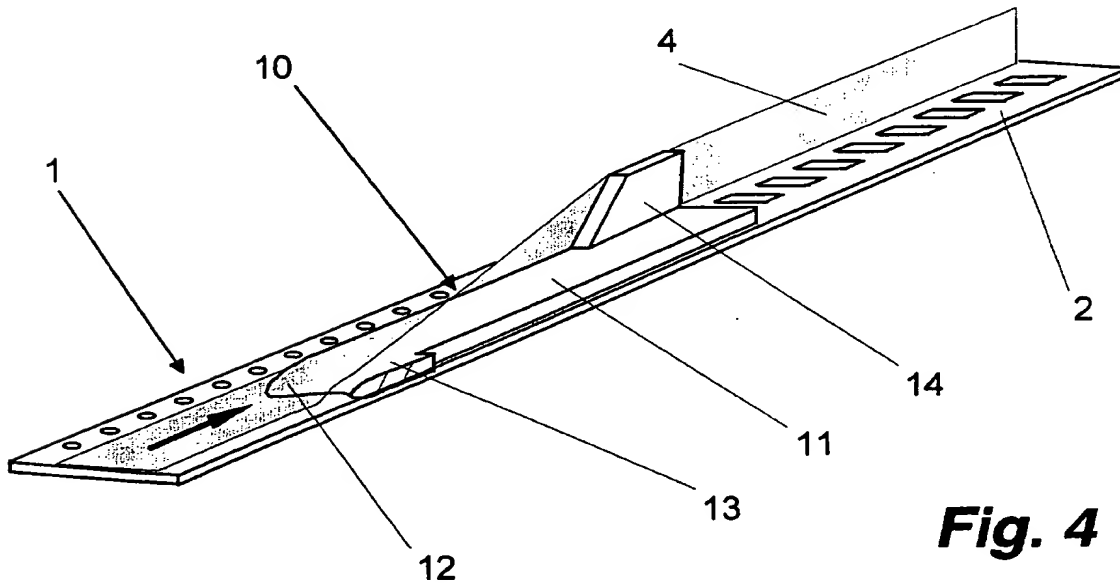
**Fig. 1**



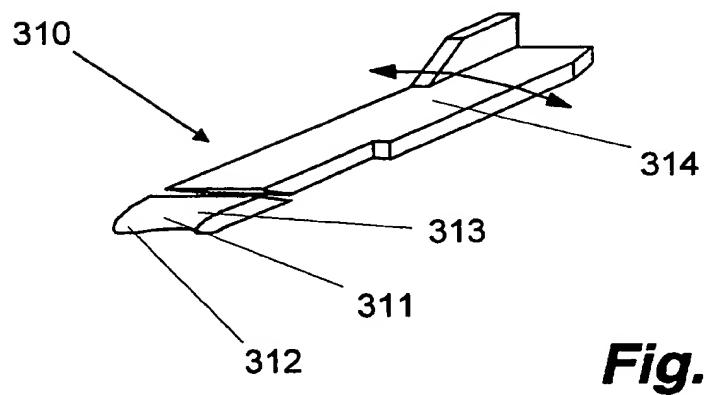
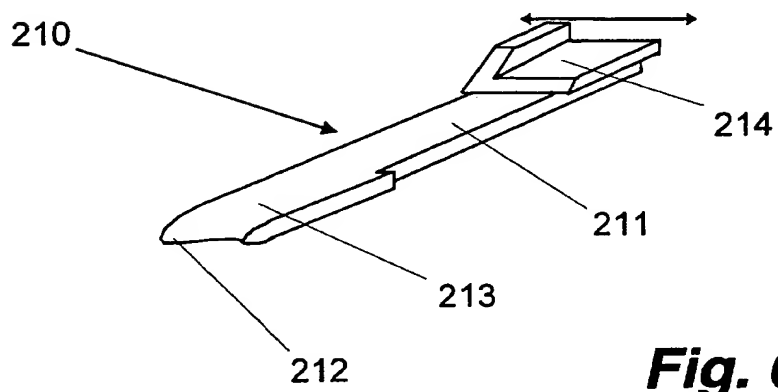
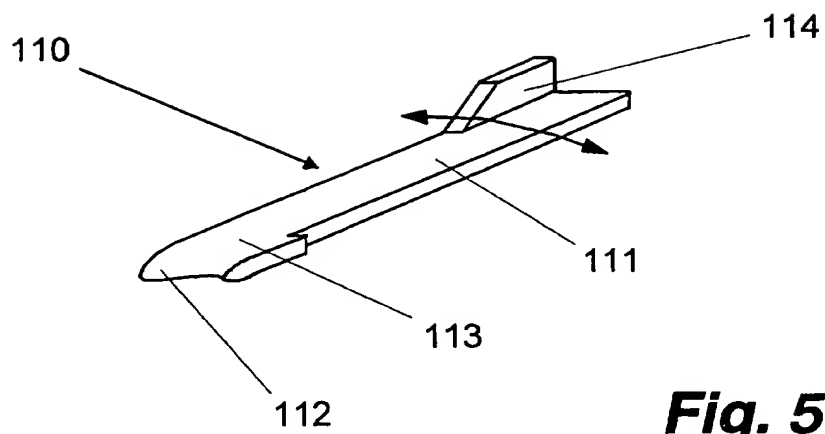
**Fig. 2**

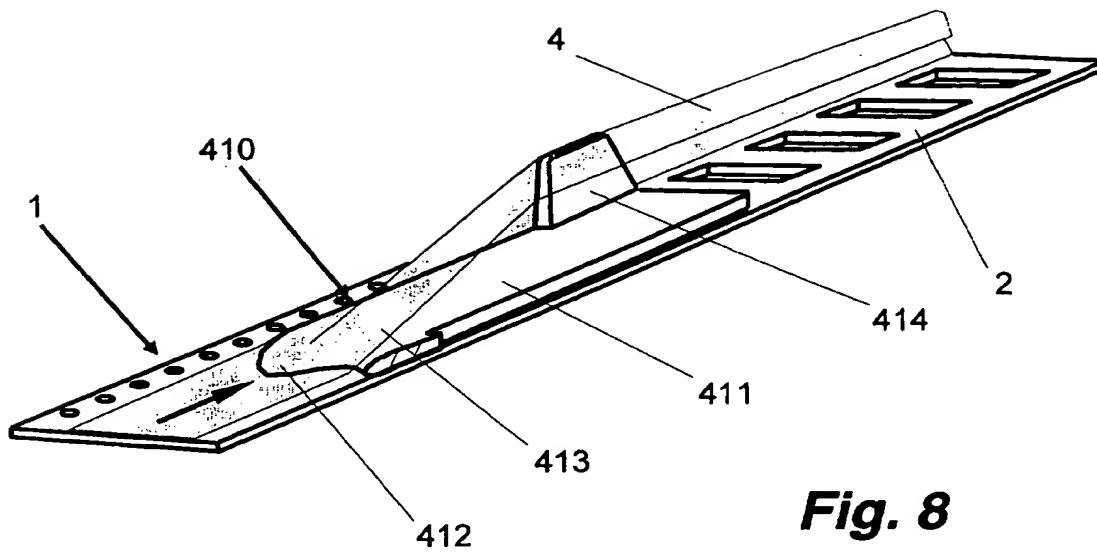


**Fig. 3**

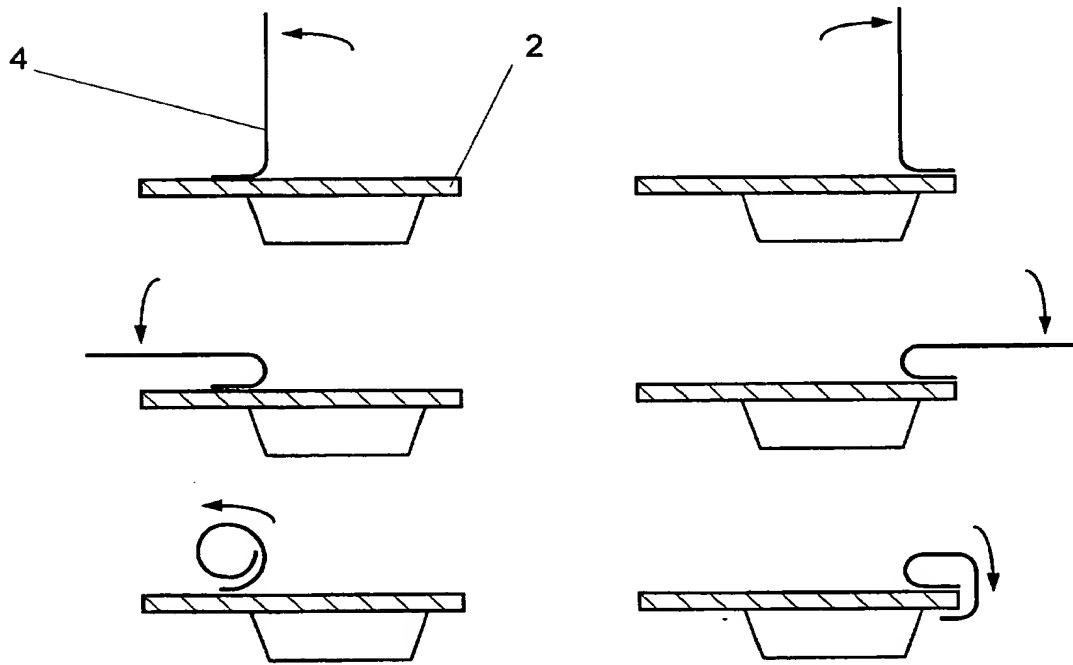


**Fig. 4**

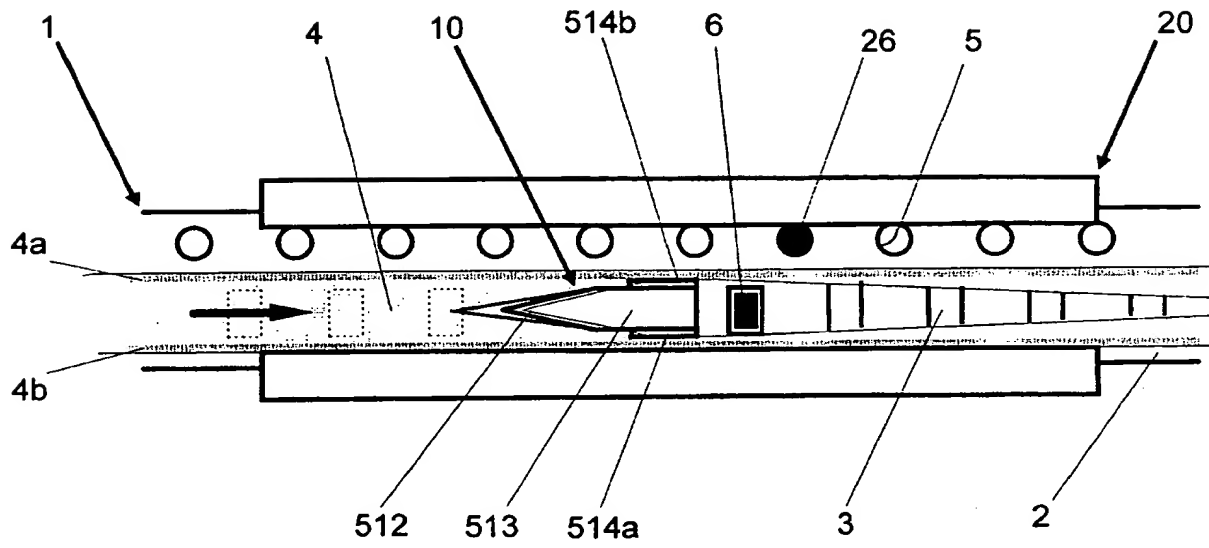




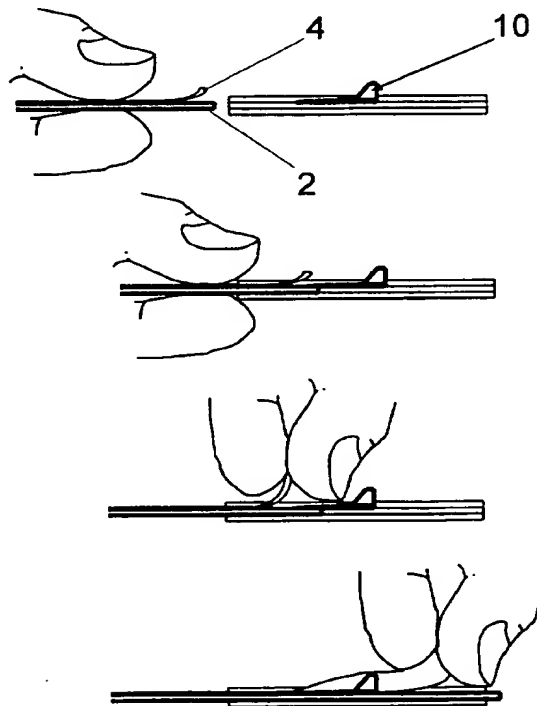
**Fig. 8**



**Fig. 9**

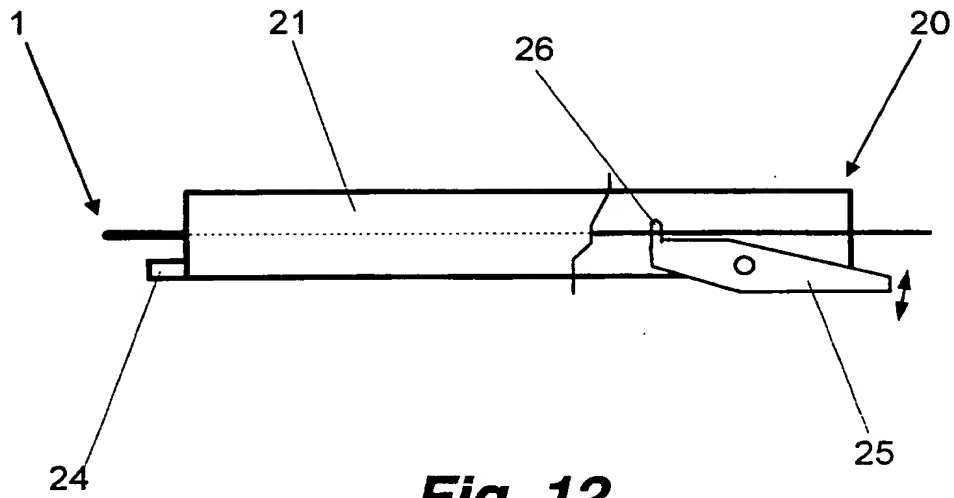


**Fig. 10**

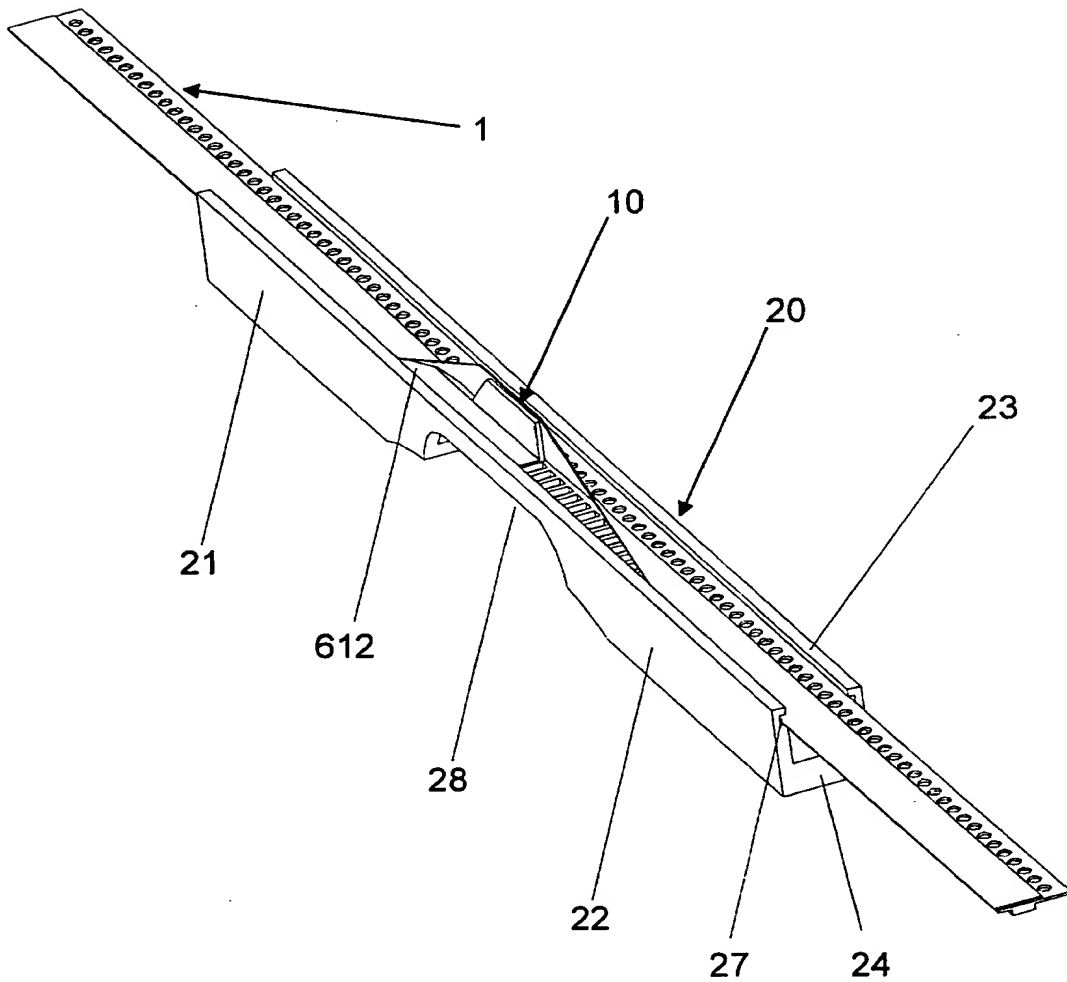


**Fig. 11**





**Fig. 12**



**Fig. 13**